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Effects of Commercial Clearcutting of Aspen on Understory Vegetation and Wildlife Habitat Values in Southwestern Colorado

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Abstract

Commercial clearcutting of aspen in southwestern Colorado produced aspen sprouts, but caused relatively few lasting changes in other understory plant characteristics 5 years after logging. The most negative impact of logging on wildlife habitat was removal of the overstory, which adversely affected cavity-nesters and other species requiring mature forest.

[1]*Headquarters is in Fort Collins, in cooperation with Colorado State University.*

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Management Implications

Aspen (*Populus tremuloides*) is clearcut in the central Rocky Mountains to obtain wood products, to enhance its value as wildlife habitat, and to ensure its perpetuation for scenic beauty. Clearcutting is especially important since much of the aspen is mature, and fire, its natural regenerative force, has been successfully suppressed in recent years. Commercial clearcutting is probably the most economical method to renew aspen, but usually requires logging relatively large acreages to recover operating costs.

Except for overstory loss, clearcutting and removal of logs in more than 60 nearby blocks of mature aspen ranging in size from 2 to 20 acres resulted in few lasting changes in understory plant characteristics during 5 years after logging. Overstory removal adversely affected cavity-nesters and other species requiring mature forest, but clearing for roads and harvesting should benefit species needing sparsely vegetated areas and forest edges, and those favoring tall, dense, shrub-like habitats provided by aspen sprouts in older clearcuts.

In future sales, wildlife benefits can be enhanced by extending timber sales in local areas over 10 years or more or by making several sales periodically. These options would reduce the acreage of overstory removed at one time and also prolong benefits to species favoring forest openings.

Introduction

Aspen (*Populus tremuloides* Michx.) is the most abundant deciduous tree in the central Rocky Mountains. Aspen provides habitat for many wild birds and mammals, and may be essential for some species (Reynolds 1969, Gruell and Loope 1974, Flack 1976, Armstrong 1977, DeByle 1981). Aspen forests also produce large amounts of forage, offer shelter for livestock, and are one of the outstanding scenic features of the Rocky Mountain states.

Aspen of sufficient size and soundness for wood products grow throughout the central Rockies, but demand is currently low in most areas. As economic values of aspen timber increase, forest managers must learn how to harvest aspen with maximum benefits to all resources, including wildlife (Wengert 1976).

One of the few relatively stable markets for aspen logs is in southwestern Colorado, where the San Juan National Forest has sold aspen stumpage regularly for more than 30 years. A timber sale in the early 1970's produced more than 60 clearcut blocks, ranging in size from 2 to 20 acres, that were logged between 1974 and 1978. The sale area provided a unique opportunity to evaluate major changes in wildlife habitat and use by selected herbivores that had occurred since cutting began. The relative uniformity of the aspen stand, use of up-to-date logging and slash disposal technology, and availability of several clearcut blocks of various sizes in five different post-logging age classes, provided an uncommon chance to study plant succession and wildlife responses to commercial clearcutting in a short period of time.

This paper reports on logging-induced changes in understory vegetative characteristics that influence relative values of these aspen stands as wildlife habitat.

The Study Area

The study was conducted on west Stoner Mesa, about 25 miles northeast of Dolores, Colo. Elevations averaged about 9,200 feet in the gentle topography of that part of the sale area that was investigated. The site was occupied by a nearly pure stand of mature aspen averaging about 650 trees per acre, ranging from less than 1 to more than 20 inches d.b.h., and up to 90 feet in height (fig. 1). Basal area averaged 198 square feet per acre, and average site index was estimated at 60. Overstory cover averaged 85 percent (Crouch 1982). According to Dolores Ranger District records, about 600 acres, or 25 percent of the stand in addition to clearings for roads, was clearcut, mainly in the dormant season.

The overstory cover was dense and mostly resembled elements of the *Populus tremuloides/Symphoricarpos oreophilus* and *P. tremuloides/Thalictrum fendleri* habitat types described by Hoffman and Alexander (1980) on the Routt National Forest some 200 miles northeastward.

West Stoner Mesa provided spring, summer, and fall habitat for mule deer (*Odocoileus hemionus*), elk (*Cervus canadensis*), and seasonal habitat for other game and

nongame birds and mammals. Cattle also grazed there each summer.

Methods

Data on understory vegetation and herbivore use were collected from 18 different blocks. Fifteen were clearcut, with merchantable logs removed, and slash scattered. Among these, 3 blocks were selected from each year of logging and slash treatment, from winter 1974 through winter 1978. Within each year class, one block was selected from each of the following size classes: 2-7, 8-13, and 14-19 acres. All blocks were rectangular. In addition, one block corresponding to each size-class was established in uncut aspen as a control. These control blocks were isolated from clearcut blocks by at least 200 feet. The 15 clearcut blocks plus 3 controls made up the study sites.

Data were collected on two sampling lines established across the longer axis of each block. Lines were placed approximately equidistant from the block edges and from each other.

Plant Production and Ground Cover

Plant production was determined by clipping current growth of all understory vegetation within square, 1 square-foot plots located at 55-foot intervals along each sampling line. Aspen leaves, shrubs, grasses, and forbs were sacked separately, weighed green in the field, and later oven-dried at 55°C to determine moisture content.

Plant cover by species was measured in 1- by 2-inch rated microplots spaced 10 feet apart on each sampling line. Cover of all species within 5 feet of ground surface was estimated by 10-percent increments in microplots, as described by Morris (1973). Aspen sprouts were also inventoried in permanent plots at every fifth microplot location (Crouch 1982).

Figure 1.—Uncut aspen block on Stoner Mesa study area.

Production and cover were sampled near the peak of the growing season, in late July 1979.

Relative understory quality was evaluated by comparing crude protein content and dry matter digestibility derived according to procedures described by Regelin et al. (1974). Rumen inoculum from a domestic cow, fed grass hay, was used in digestibility determinations.

Herbage Utilization

Large herbivore use of grasses and forbs was estimated from differences in biomass of these plants inside and outside five, circular, 7.5 square foot wire cages erected 55 feet apart along one sampling line in each block. For these determinations, in late September grasses and forbs were clipped and sacked separately from one, square, 1 square-foot plot inside and outside each cage. Results are expressed in pounds per acre dry weight, determined by multiplying percent utilized by herbage available.

Large Herbivores

Big game and livestock activity was estimated in fall 1979, from fecal counts made on 8-foot wide transects extending along each sampling line in fall 1979.

Data Analysis

Analysis of variance ($P = 0.05$) was used to test for differences among year and size classes for all understory plant attributes and fecal counts on established transects. Tukey's test was used to separate means, where appropriate (Snedecor 1961). Orthogonal comparisons were used to test differences between uncut and the means of collective clearcut values within categories.

Results

Clearcutting completely removed the aspen overstory and replaced the 650 existing trees per acre with more than 30,000 sprouts per acre by the end of the first growing season after logging (Crouch 1982). Various amounts of slash also remained (fig. 2). By the second year after logging, aspen sprouts were the dominant visual growth form on clearcuts (fig. 3).

Plant Production

Except for the first year after logging, annual growth of woody plants was greater on clearcuts than on uncut blocks (Table 1).[2] The increase resulted mainly from a gain in aspen rather than from shrubs, which did not respond to logging.

[2]*Greater or lesser, increases or decreases, etc., indicate that values reported are significantly different at P = 0.05.*

Figure 2.—First-year clearcut on Stoner Mesa study area.

Figure 3.—Second-year clearcut on Stoner Mesa study area.

Graminoid (grass and sedge) production was lower on first-year clearcut blocks than on uncut or older clearcuts, but recovered quickly. The 5-year mean production on clearcuts was not different from that on uncut areas (Table 1). Quantities of forbs were depressed on first-year blocks, but not different from controls over the 5-year period, although production indicated a gaining trend on older blocks.

Total herbage production (graminoids and forbs) was not different on clearcuts compared to uncut blocks. Less herbage was present on first-year clearcuts, but quantities increased markedly thereafter.

Total amounts of understory vegetation were greater on clearcuts than on uncut blocks. Growth was suppressed on first-year clearcuts, but exceeded production on controls and in 2- to 5-year-old blocks. Block size had no effect on plant production.

Herbage Utilization

Herbivores, mainly cattle fed on vegetation on all blocks, and utilization was heavy on several of the clearcut areas (Table 1). Use of graminoids was greater on intermediate-aged clearcuts than on uncut or the newest and oldest logged blocks. Although use reached 80 percent of the available crop on two clearcut blocks, the overall averages were 21 and 43 percent of graminoids on the uncut and clearcut blocks, respectively. Quantities of forbs used were greater on older clearcuts than on uncut or newer blocks. Use rates reached 60 percent on two clearcuts near stock ponds, but averaged 24 and 33 percent on uncut blocks and among all clearcuts, respectively.

Ground Cover

Forbs were the dominant plant cover in the understory of uncut blocks (fig. 4, Table 2). Collectively, the 35 species of forbs recorded in microplots contributed 79 percent, graminoids 13 percent, and woody species 8 percent of the total cover.

Table 1.—Dry weight understory plant production (lb/acre) and herbage utilization (lb/acre) on uncut and clearcut aspen blocks on Stoner Mesa, San Juan National Forest, southwestern Colorado, 1979

Category	Uncut	Years since logging[1]					Uncut[2]	Clearcuts[2]
		1	2	3	4	5		
Aspen	20b	19b	382a	354a	477a	509a	20a	348b
Shrubs	136a	55a	158a	199a	204a	183a	136a	160a
All woody plants	156b	74b	541a	552a	681a	691a	156a	508b
Graminoids	392a	162b	378a	360a	372a	317a	392a	318a
Forbs	967b	566c	1,061b	1,164b	1,208b	1,574a	967a	1,115a
All herbage	1,359b	728c	1,439ab	1,524ab	1,581ab	1,892a	1,359a	1,433a
All plants	1,515b	802c	1,980a	2,076a	2,261a	2,583a	1,515a	1,940b
Herbage utilization								
Graminoids	81b	76b	160a	193a	163a	93b	81a	137b
Forbs	233b	199b	223b	477a	510a	459a	233a	374b

[1]*Within categories, values among years followed by the same letter are not significantly different (P = 0.05).*
[2]*Within categories, uncut and the mean value for clearcuts followed by the same letter are not significantly different (P = 0.05).*

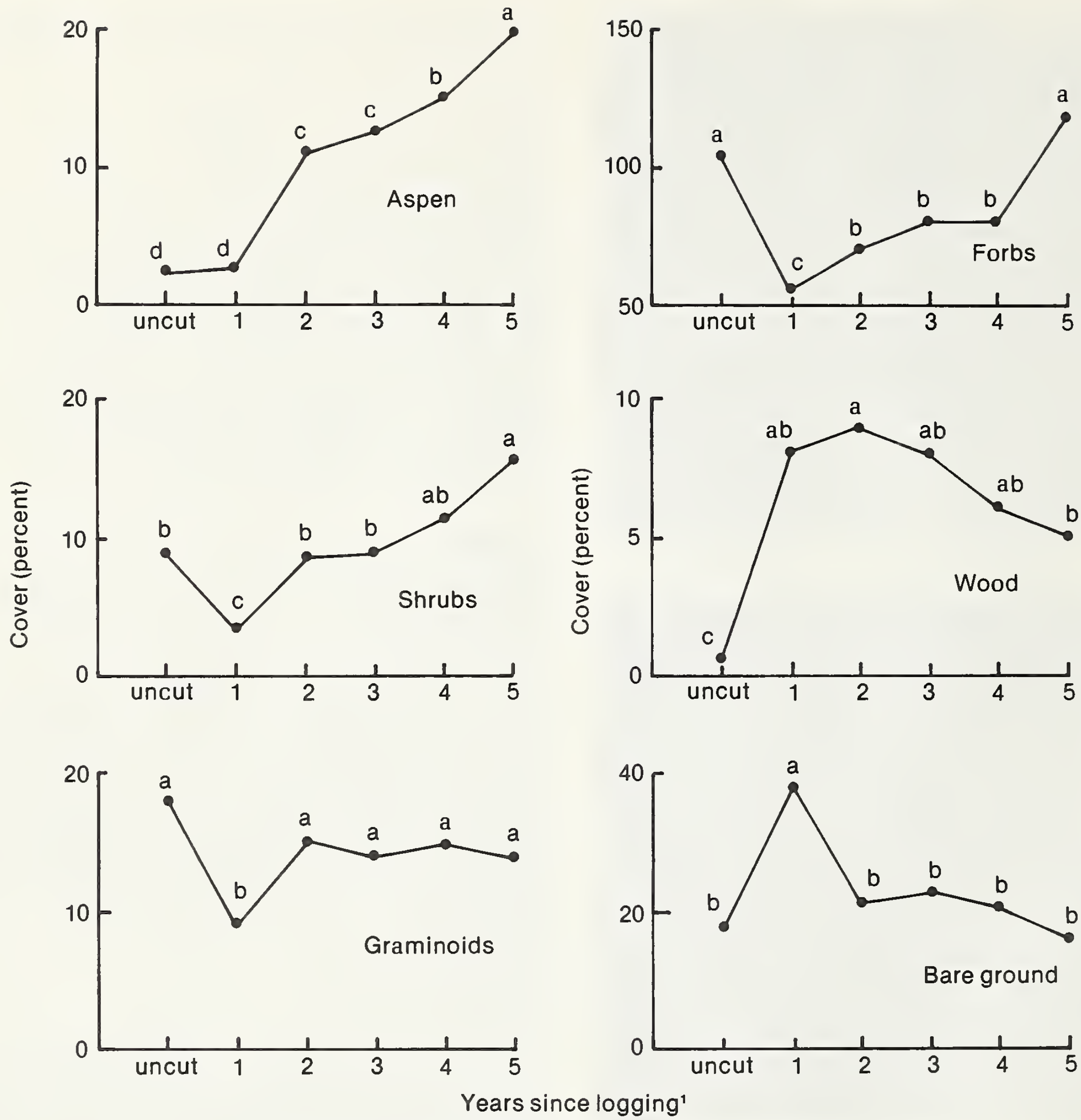

Figure 4.—Ground cover in clearcuts on Stoner Mesa study area. (Within categories, values among years followed by the same letter are not significantly different; P = 0.05.)

Individual species of understory plants were variously affected by clearcutting. Among woody plants, only aspen changed, increasing in cover over the 5 years after logging. Cover of the two most common grasses, *Poa pratensis* and *Elymus glaucus* was diminished by logging and had not recovered in fifth-year blocks. Cover of *Bromus ciliatus* was greater in older blocks than on the uncut or younger clearcuts.

Forbs showed the largest fluctuations among species. Cover of 7 of the 10 most abundant forbs was lower on first-year clearcuts than on uncut blocks (Table 2). On fifth-year sites, cover of six of these species was no longer different from controls, and cover of two species, *Ligusticum porteri* and *Achillea lanulosa*, exceeded that on uncut blocks. Among other forbs, only *Veratrum californicum* and *Smilacina stellata* were lower in cover on fifth-year blocks than on the controls, whereas *Osmorhiza obtusa* and *Mertensia franciscana* were more abundant 5 years after clearcutting.

Comparisons of cover of forb species on uncut blocks with that on clearcuts of all ages showed that annual means of 6 of the 10 leading species were lower on the clearcut areas during the 5 years after logging (Table 2).

Influence of block size on plant cover varied widely among species, and no consistent pattern of size effect was evident.

Cover of wood, including logging slash and natural mortality, which was negligible on uncut blocks, increased on clearcuts immediately after logging, and showed a declining trend thereafter (fig. 4). Compared with uncut blocks, amounts of bare ground doubled in first-year clearcuts, but had declined to levels found in the forest by the second, post-logging growing season.

Table 2.—Percent understory plant cover on uncut and clearcut aspen blocks on Stoner Mesa, San Juan National Forest, southwestern Colorado, 1979

Growth form and species[1]	Uncut	Years since logging[2] 1	2	3	4	5	Uncut[3]	Clearcuts[3]
Woody plants								
Symphoricarpos oreophilus	7.8abc	2.2c	4.9bc	8.1abc	9.7ab	11.8a	7.8a	7.3a
Populus tremuloides	2.2d	2.3d	10.8c	12.8bc	14.8b	18.9a	2.2a	11.9b
Rosa woodsii	0.9a	0.6a	1.6a	0.4a	0.6a	0.6a	0.9a	0.8a
Potentilla fruticosa	0.4a	0.6a	1.4a	0.2a	0.4a	1.4a	0.4a	0.8a
Graminoids								
Poa pratensis	6.4a	0.5c	2.7bc	2.6bc	2.1bc	3.3b	6.4a	2.2b
Carex festivella	5.4ab	4.2b	7.9a	6.9ab	7.8a	5.0b	5.4a	6.4a
Elymus glaucus	4.1a	2.6ab	3.9ab	3.1ab	0.9ab	0.3b	4.1a	2.2b
Bromus ciliatus	1.2b	1.0b	1.2b	1.4b	2.0ab	3.5a	1.2a	1.8a
Calamagrostis canadensis	0.8a	0.7a	0.7a	1.2a	1.1a	0.9a	0.8a	0.9a
Melica sp.	0.4a	0.1a	0.3a	0.1a	0.1a	0.2a	0.4a	0.2a
Forbs								
Erigeron speciosus	18.1a	5.8c	6.6bc	10.6bc	11.5b	20.0a	18.1a	10.9b
Thalictrum fendleri	18.0a	7.0c	8.5c	9.4c	11.3bc	16.3ab	18.0a	10.5b
Ligusticum porteri	12.1a	10.4a	8.5a	9.2a	11.7a	20.0b	12.1a	12.0a
Thermopsis montana	8.1a	2.7b	6.6ab	6.8ab	7.9a	7.2ab	8.1a	6.2b
Galium boreale	6.6a	4.1b	5.3b	7.0a	7.6a	6.0a	6.6a	6.0a
Fragaria ovalis	6.1a	2.7a	2.8a	2.7a	5.3a	5.0a	6.1a	3.7b
Lathyrus arizonicus	5.8a	2.2b	5.2ab	4.9ab	4.7ab	7.1a	5.8a	4.8a
Taraxacum officinale	4.7a	1.3b	4.7a	2.8ab	3.5ab	5.0a	4.7a	3.5a
Geranium richardsonii	3.5ab	0.9b	0.6b	1.5b	1.2b	4.2a	3.5a	1.7b
Achillea lanulosa	3.0c	0.7d	4.4bc	4.8abc	6.8a	5.9ab	3.0a	4.5b
Viola spp.	2.3a	0.6a	0.1a	0.9a	0.2a	1.4a	2.3a	0.6b
Osmorhiza obtusa	2.2b	0.4b	0.9b	0.9b	1.7b	4.9a	2.2a	1.8a
Veratrum californicum	2.2a	0.6b	0.2b	0.2b	0.9b	0.9b	2.2a	0.6b
Frasera speciosa	1.7a	0.3a	0.2a	0.3a	0.6a	0.7a	1.7a	0.4b
Cirsium spp.	1.2a	0.2a	6.0b	1.7a	2.8a	1.1a	1.2a	2.4a
Smilacena stellata	1.1a	0.1b	0.1b	0.1b	0.1b	1.1a	1.1a	0.3b
Allium textile	1.0a	0.5a	0.9a	0.1a	0.1a	0.1a	1.0a	0.3a
Helianthella quinquenervis	1.0a	0.0a	1.3a	0.0a	0.0a	0.4a	1.0a	0.3a
Pseudocymopterus montanus	0.9ab	0.3b	1.1ab	1.3ab	2.5a	0.4b	0.9a	1.1b
Vicia americana	0.9a	0.7a	1.2a	2.0a	1.0a	1.3a	0.9a	1.2a
Mertensia franciscana	0.8b	0.9b	0.1b	1.3b	1.4b	3.8a	0.8a	1.5a
Helenium hoopsesii	0.6a	0.1a	0.2a	0.1a	0.1a	0.1a	0.6a	0.1b
Potentilla gracilis	0.4a	0.2a	1.2a	0.2a	0.4a	1.5a	0.4a	0.7a
Solidago multiradiata	0.3a	0.7a	0.2a	1.8a	1.6a	0.9a	0.3a	1.0a
Chenopodium capitatum	0.3a	0.2a	0.1a	0.0a	0.1a	0.5a	0.3a	0.2a
Castilleja miniata	0.3a	1.0a	1.2a	0.8a	0.5a	0.1a	0.3a	0.7a
Pedicularis grayi	0.0a	2.1a	0.5a	0.9a	0.3a	1.0a	0.0a	1.0a

[1] *Two other shrub, four graminoid, and 8 forb species were also occasionally recorded in mircroplots.*
[2] *Within species, values among years followed by the same letter are not significantly different ($P = 0.05$).*
[3] *Within species, uncut and the mean value for clearcuts followed by the same letter are not significantly different ($P = 0.05$).*

Moisture Content

Moisture content of aspen leaves and shrubs from first-year clearcuts was higher than in those collected in uncut or older clearcuts (Table 3). Moisture in graminoids collected from first-year clearcuts was lower than in samples from uncut blocks and remained low on the older logged areas. Moisture in forbs from first- and second-year blocks was lower than in samples from uncut areas or older clearcuts. Comparisons of moisture amounts in plants from uncut areas with amounts in samples from all ages of clearcuts showed a significant difference only in graminoids (Table 3). Block size had no effect on moisture content.

Crude Protein

Aspen leaves and shrubs from newer clearcuts contained more crude protein than samples collected on uncut or older logged blocks (Table 4). The average content was higher in material from clearcuts collectively

Table 3.—Percent moisture content of understory vegetation on uncut and clearcut aspen blocks on Stoner Mesa, San Juan National Forest, southwestern Colorado, 1979

Category	Uncut	Years since logging[1]					Uncut[2]	Clearcuts[2]
		1	2	3	4	5		
Aspen leaves	65.8bc	71.1a	70.2ab	65.0c	63.4c	61.5c	65.8a	66.2a
Shrubs	63.8b	72.8a	60.1b	64.1b	60.6b	62.0b	63.8a	63.9a
Graminoids	71.5a	61.8b	59.9b	67.7ab	67.6ab	63.6b	71.5a	64.1b
Forbs	78.1ab	75.5c	74.3c	77.4ab	78.7a	79.0a	78.1a	77.0a

[1]*Within categories, values among years followed by the same letter are not significantly different (P = 0.05).*
[2]*Within categories, uncut and the mean value for clearcuts followed by the same letter are not significantly different (P = 0.05).*

Table 4.—Dry weight crude protein content (%) of understory vegetation on uncut and clearcut aspen blocks on Stoner Mesa, San Juan National Forest, southwestern Colorado, 1979

Category	Uncut	Years since logging[1]					Uncut[2]	Clearcuts[2]
		1	2	3	4	5		
Aspen leaves	16.7d	20.9b	22.1a	18.4c	18.7c	16.3d	16.7a	19.3b
Shrubs	13.9c	21.2a	16.1b	15.6b	15.6b	12.7c	13.9a	16.2b
Graminoids	11.7a	12.8a	11.9a	11.4a	12.7a	11.7a	11.7a	12.1a
Forbs	14.8a	14.3a	14.6a	14.4a	14.7a	14.6a	14.8a	14.5a

[1]*Within categories, values among years followed by the same letter are not significantly different (P = 0.05).*
[2]*Within categories, uncut and the mean value for clearcuts followed by the same letter are not significantly different (P = 0.05).*

than in aspen and shrubs from uncut sites. Amounts of crude protein in graminoids and forbs were not different among year-classes of clearcuts or between samples from uncut and logged blocks.

Crude protein available in the standing crop of understory vegetation is shown in Table 5. Amounts were calculated by multiplying kg/ha of vegetation by percentage of crude protein content in the various growth form categories.

Aspen leaves and forbs contained the largest reservoir of crude protein. The amount contributed by aspen was low on first-year clearcut and uncut blocks because little aspen grew there. Amounts available in shrubs were unaffected by logging (Table 5).

Crude protein available in graminoids was lower on the newest clearcuts because quantities of these plants were lower there. The mean amount in graminoids among all clearcuts was not different from that on uncut blocks.

The quantity of crude protein in forbs was lower on first-year clearcuts and uncut blocks than in forbs on older clearcuts, but amounts in uncut blocks and mean quantities on clearcuts were not different.

Availability of crude protein in the total understory component was lowest in first-year clearcut and uncut blocks. Vegetation in clearcuts collectively, contained more crude protein per hectare than in uncut blocks.

Digestibility

In vitro digestibility of aspen leaves, shrubs, and graminoids in samples collected on first-year clearcuts was greater than in those obtained on older clearcuts or uncut blocks (Table 6). Digestibility of samples of these growth forms from the collective clearcuts was greater than samples from controls. Digestibility of forbs was unaffected by logging. Block size had no effect on digestibility.

Herbivore Activity

Numbers of cattle droppings were greater on older clearcuts than on uncut or recently logged blocks (Table 7). Cattle sign was also more prevalent on smaller than on larger blocks. Fewer deer pellet groups were observed on uncut and older clearcut blocks than on those more recently logged. Numbers of elk droppings were low and not different among clearcut and uncut blocks. Abundance of deer and elk sign was unaffected by block size.

The consumption of feces by unknown species of dung beetles on the Stoner Mesa area is assumed to have negligible effects on comparisons among the blocks studied, but may preclude comparisons of counts there with inventories elsewhere.

Discussion

After five years, commercial clearcut logging of aspen on Stoner Mesa had resulted in relatively few major changes in understory characteristics. Except for large increases in numbers of aspen sprouts, which were expected, other responses were minimal. Production of

shrubs, graminoids, and forbs was depressed on first-year clearcuts, but recovered to levels found in uncut blocks by the second year after logging. Among all plants, more vegetation was present on clearcuts collectively than on uncut blocks, but the difference was mainly attributed to more aspen on the logged blocks. Five years after logging, the cover of only one common grass, *Elymus glaucus*, and one uncommon forb, *Allium textile*, were declining compared with their presence on uncut or newer clearcut blocks.

Utilization of graminoids and forbs was greater in clearcuts and is attributed to the greater tendency of cattle to graze there than in the forest. Clearcutting on Stoner Mesa can probably be considered a range improvement practice for cattle.

The open character of the clearcuts immediately after logging was greatly diminished in older blocks, despite the presence of logging slash, roads, and bare ground resulting from yarding and log decks. Fifth-year clearcuts offered as much or more growing-season hiding cover to herbivores than the uncut forest (fig. 5). Observations made in 1981, on 7-year-old clearcuts, showed aspen sprouts exceeding 20 feet in height, with average canopy heights of about 8 feet. Although no measurements were taken at that time, it appeared that herbage production was declining as the sprout stands matured. The density of larger sprouts also appeared to impede the movement of large herbivores, whose activity seemed to be primarily on well-defined trails in the older blocks.

Although the timber sale was not specifically designed for wildlife benefits, the pattern of clearcutting and the logging practices employed appear to have had minimal adverse impacts and several favorable effects on the general suitability of the sale area as wildlife habitat.

Table 5.—Dry weight crude protein availability (lb/acre) from understory vegetation on uncut and clearcut aspen blocks on Stoner Mesa, San Juan National Forest, 1979

Category	Uncut	Years since logging[1] 1	2	3	4	5	Uncut[2]	Clearcuts[2]
Aspen leaves	4b	5b	85a	65a	90a	83a	4a	66b
Shrubs	19a	12a	26a	31a	32a	23a	19a	25a
Graminoids	45a	21b	45a	41a	47a	37a	45a	38a
Forbs	144b	81c	156b	167ab	177ab	229a	144a	162a
All plants	211b	118c	312a	305a	346a	372a	211a	291b

[1] *Within categories, values among years followed by the same letter are not significantly different (P = 0.05).*
[2] *Within categories, uncut and the mean value for clearcuts followed by the same letter are not significantly different (P = 0.05).*

Table 6.—*In vitro* digestibility (% dry matter) of understory vegetation on uncut and clearcut aspen blocks on Stoner Mesa, San Juan National Forest, July 1979

Category	Uncut	Years since logging[1] 1	2	3	4	5	Uncut[2]	Clearcuts[2]
Aspen leaves	45.6c	58.2a	55.1b	55.6b	56.0b	51.4c	45.6a	55.3b
Shrubs	53.9c	66.1a	59.2b	59.8b	54.4c	54.6c	53.9a	58.8b
Graminoids	61.8b	66.4a	68.1a	66.4a	66.2a	63.0b	61.8a	66.0b
Forbs	71.5a	73.1a	71.9a	72.9a	70.2a	70.9a	71.5a	71.8a

[1] *Within categories, values among years followed by the same letter are not significantly different (P = 0.05).*
[2] *Within categories, uncut and the mean value for clearcuts followed by the same letter are not significantly different (P = 0.05).*

Table 7.—Numbers of fecal groups per acre on uncut and clearcut aspen blocks on Stoner Mesa, San Juan National Forest, southwestern Colorado, 1979

Animal	Uncut	Years since logging[1] 1	2	3	4	5	Uncut[2]	Clearcuts[2]
Cattle	190b	145b	267b	509a	494a	534a	190a	390b
Deer	35b	94a	96a	106a	67ab	22b	35a	77b
Elk	7a	7a	10a	32a	30a	10a	7a	18a

[1] *Within species, values among years followed by the same letter are not significantly different (P = 0.05).*
[2] *Within species, uncut and the mean value for clearcuts followed by the same letter are not significantly different (P = 0.05).*

Figure 5.—Aspen sprouts in a fifth-year clearcut on Stoner Mesa study area.

The most obvious impact of logging on wildlife habitat was removal of the overstory, which adversely affected cavity-nesters and other species requiring a mature aspen forest. Clearcutting should have benefited species needing sparsely vegetated areas, at least initially, and those requiring tall, dense, shrub-like habitats that were provided by aspen sprouts in older blocks. Birds needing open foraging sites adjacent to standing timber also should have benefited from the cutting pattern employed. Although saleable logs were removed from the clearcuts, much more cover and possibly food was provided by logging slash in the clearcuts than by natural mortality in the adjacent forest.

The magnitude of feeding by wild herbivores was not quantitatively evaluated, but it was assumed from observations and pellet group counts that most of the feeding evidence resulted from cattle. A few deer and elk were present through the growing season, but the study area appeared to be used by these animals mainly during transit from summer to winter ranges.

Retention of a few large, windfirm trees per hectare would have been useful, especially in the larger clearcuts. Fewer skid trails might have produced less area of severely disturbed soil and provided fewer opportunities for livestock concentrations. Also, larger uncut buffers around water holes could have reduced trampling and compaction in nearby clearcuts.

In retrospect, from a wildlife habitat viewpoint, more benefits would probably have accrued if the timber sale had been extended over 10 years or more, or if several sales had been made over a longer period. These options would have produced newly-logged blocks each year, spaced over a wide area, which could have prolonged benefits to clearcut oriented species. However, such a pattern might have concentrated cattle on fewer areas and resulted in failure to regenerate the aspen.

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Crouch, Glenn L. 1983. Effects of commercial clearcutting on understory vegetation and wildlife habitat values in southwestern Colorado. USDA Forest Service Research Paper RM-246, 8 p. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.

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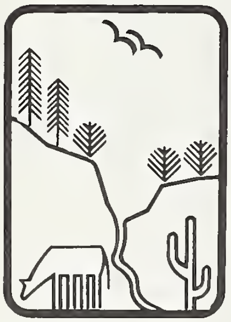

Southwest

Great Plains

The Rocky Mountain Station is one of eight regional experiment stations, plus the Forest Products Laboratory and the Washington Office Staff, that make up the Forest Service research organization.

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Research programs at the Rocky Mountain Station are coordinated with area universities and with other institutions. Many studies are conducted on a cooperative basis to accelerate solutions to problems involving range, water, wildlife and fish habitat, human and community development, timber, recreation, protection, and multiresource evaluation.

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*Station Headquarters: 240 W. Prospect St., Fort Collins, CO 80526